

What is claimed is:

1. A thin-film magnetic head comprising:

a medium facing surface that faces toward a recording medium;

a first pole layer and a second pole layer including magnetic pole

5 portions that are opposed to each other and located in regions of the pole layers on a side of the medium facing surface;

a coupling section that is located away from the medium facing surface, includes at least one of a portion of the first pole layer and a portion of the second pole layer, and magnetically couples the first and second pole layers to
10 each other;

a gap layer provided between the pole portion of the first pole layer and the pole portion of the second pole layer;

a thin-film coil wound around the coupling section, a part of the coil being disposed between the first and second pole layers and insulated from
15 the first and second pole layers;

a cooling layer for cooling the first pole layer and the thin-film coil; and

a substrate, wherein:

the first and second pole layers, the gap layer, the thin-film coil and the cooling layer are stacked on the substrate, and the first pole layer is located
20 closer to the substrate than the second pole layer;

the first pole layer and the cooling layer are made of an identical magnetic material;

each of the first pole layer and the cooling layer has a coil facing portion that faces toward one of surfaces of the thin-film coil closer to the substrate;

25 the coil facing portion of the cooling layer is located farther from the medium facing surface than the coil facing portion of the first pole layer; and

the coil facing portion of the first pole layer is separated from the coil facing portion of the cooling layer with a gap.

2. The thin-film magnetic head according to claim 1, further comprising
5 a first insulating portion made of an insulating material and disposed between the first pole layer and the thin-film coil, and a second insulating portion made of an insulating material and disposed between the cooling layer and the thin-film coil, wherein the first insulating portion is thicker than the second insulating portion.

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3. The thin-film magnetic head according to claim 1, wherein:
each of the first pole layer and the cooling layer has side surfaces;
the side surfaces of the first pole layer include: a first portion exposed from the medium facing surface; a second portion opposite to the medium
15 facing surface; a third portion coupling an end of the first portion to an end of the second portion; and a fourth portion coupling the other end of the first portion to the other end of the second portion; and

a part of the side surfaces of the cooling layer faces with a specific space toward the second, third and fourth portions of the side surfaces of the first
20 pole layer.

4. The thin-film magnetic head according to claim 1, further comprising an insulating layer disposed between the first pole layer and the cooling layer, wherein the first pole layer, the cooling layer and the insulating layer have
25 flattened top surfaces.

5. The thin-film magnetic head according to claim 1, further comprising two connecting portions that are disposed on both sides of the thin-film coil and connect the first pole layer to the cooling layer, wherein the connecting portions are made of a magnetic material the same as the first pole layer and
5 the cooling layer.

6. The thin-film magnetic head according to claim 5, further comprising an insulating layer disposed between the first pole layer and the cooling layer, wherein the first pole layer, the cooling layer, the connecting portions and the
10 insulating layer have flattened top surfaces.

7. The thin-film magnetic head according to claim 1, wherein the cooling layer has a greater area than the first pole layer.

15 8. The thin-film magnetic head according to claim 1, further comprising a magnetoresistive element disposed near the medium facing surface, and two shield layers disposed above and below the magnetoresistive element, wherein the magnetoresistive element and the two shield layers are disposed between the substrate and the first pole layer.

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9. A thin-film magnetic head comprising:
a medium facing surface that faces toward a recording medium;
a first pole layer and a second pole layer including magnetic pole portions that are opposed to each other and located in regions of the pole
25 layers on a side of the medium facing surface;
a coupling section that is located away from the medium facing surface,

includes at least one of a portion of the first pole layer and a portion of the second pole layer, and magnetically couples the first and second pole layers to each other;

5 a gap layer provided between the pole portion of the first pole layer and the pole portion of the second pole layer;

a thin-film coil wound around the coupling section, a part of the coil being disposed between the first and second pole layers and insulated from the first and second pole layers;

10 a cooling layer for cooling the first pole layer and the thin-film coil; and a substrate, wherein:

the first and second pole layers, the gap layer, the thin-film coil and the cooling layer are stacked on the substrate, and the first pole layer is located closer to the substrate than the second pole layer;

15 the cooling layer has a thermal conductivity equal to or greater than a thermal conductivity of the first pole layer;

each of the first pole layer and the cooling layer has a coil facing portion that faces toward one of surfaces of the thin-film coil closer to the substrate;

the coil facing portion of the cooling layer is located farther from the medium facing surface than the coil facing portion of the first pole layer; and

20 the coil facing portion of the first pole layer is separated from the coil facing portion of the cooling layer with a gap.

10. The thin-film magnetic head according to claim 9, further comprising a first insulating portion made of an insulating material and disposed
25 between the first pole layer and the thin-film coil, and a second insulating portion made of an insulating material and disposed between the cooling layer

and the thin-film coil, wherein the first insulating portion is thicker than the second insulating portion.

11. The thin-film magnetic head according to claim 9, wherein each of
5 the first pole layer and the cooling layer has side surfaces, and a part of the side surfaces of the cooling layer faces with a specific space toward a portion of the side surfaces of the first pole layer, the portion being equal to or greater than a half of the side surfaces of the first pole layer.

10 12. The thin-film magnetic head according to claim 9, further comprising an insulating layer disposed between the first pole layer and the cooling layer, wherein the first pole layer, the cooling layer and the insulating layer have flattened top surfaces.

15 13. The thin-film magnetic head according to claim 9, further comprising two connecting portions that have a thermal conductivity equal to or greater than a thermal conductivity of the first pole layer and that are disposed on both sides of the thin-film coil and connect the first pole layer to the cooling layer.

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14. The thin-film magnetic head according to claim 13, further comprising an insulating layer disposed between the first pole layer and the cooling layer, wherein the first pole layer, the cooling layer, the connecting portions and the insulating layer have flattened top surfaces.

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15. The thin-film magnetic head according to claim 9, wherein the

cooling layer has a greater area than the first pole layer.

16. The thin-film magnetic head according to claim 9, further comprising a magnetoresistive element disposed near the medium facing surface, and two
5 shield layers disposed above and below the magnetoresistive element, wherein the magnetoresistive element and the two shield layers are disposed between the substrate and the first pole layer.